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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/749,529	12/30/2003	Yuegang Zhang	21058/0206454-US0	8848

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EXAMINER	
SINES, BRIAN J	
ART UNIT	PAPER NUMBER
1797	

MAIL DATE	DELIVERY MODE
04/30/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/749,529	ZHANG ET AL.	
	Examiner	Art Unit	
	Brian J. Sines	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *4/11/2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-24 and 31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-24 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *4/11/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 4/11/2008 has been entered.

Response to Arguments

Applicant's arguments with respect to the amended claims have been considered but are moot in view of the new ground(s) of rejection. The previous prior art rejection has been modified in view of applicant's arguments and amendments.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. Claims 1, 4 – 13, 22 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ward et al. (U.S. Pat. No. 5,501,986 A) ("Ward") in view of Oyama et al. (U.S Pat. No. 5,552,274) ("Oyama") and Yamada et al. (U.S Pat. No. 6,842,088 B2) ("Yamada").

Regarding claims 1, 10 – 13, 22 and 23, Ward teaches a detection system 10 comprising: a test resonator (quartz crystal wafer 12) comprising a layer of piezoelectric material sandwiched between a pair of electrodes (14 and 16), wherein at least one surface of one of the electrodes 16 comprises a functionalized surface (e.g., coating layer 22 and surface 18) that is functionalized with a specific binding reagent 32 to bind with target molecules 34 in a liquid sample and wherein the system is configured to prevent exposure of one of the electrodes 14 to the liquid sample; and a control and detection circuitry comprising an oscillator circuit 30 (see, e.g., col. 3, line 25 – col. 6, line 20; col. 5, lines 25 – 62; figures 1 and 3). As shown in figure 1, note that only one side of the disclosed device, namely the functionalized electrode 16, is exposed to the liquid sample containing the target molecules. The other electrode 14 is not intended or required to be exposed the liquid sample.

Ward does not specifically teach the incorporation of the control circuit as claimed with the disclosed sensing device.

The applicant is advised that the Supreme Court recently clarified that a claim can be proved obvious merely by showing that the combination of known elements was obvious to try. In this regard, the Supreme Court explained that, "[w]hen there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill in the art has a good reason to pursue the known options within his or her technical grasp." An obviousness determination is not the result of a rigid formula disassociated

from the consideration of the facts of the case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not. The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. Furthermore, the simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007) (see MPEP § 2143). In this regard, Oyama teaches a similar resonator-based sensing system comprising a control circuit comprising a signal generating circuit (oscillation circuit 20) and a processing circuit 70 to measure the impedance of a resonator to facilitate target molecule detection (see, e.g., col. 5, line 60 – col. 8, line 60; figures 2, 4 and 6). As shown by Oyama, the control circuit is known and would have yielded the predictable result of facilitating effective resonator operation. Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the claimed control circuit with the disclosed sensing system of Ward in order to facilitate effective sensing device operation.

Neither Ward nor Oyama specifically teach the incorporation or substitution of a film bulk acoustic piezoelectric resonator (FBAR) and substrate configuration, and including associated control and signal generating circuits with the disclosed detection device.

Yamada does teach film bulk acoustic piezoelectric resonator (FBAR) devices that are suitable for use in various kinds of sensors (see, e.g., col. 1, lines 10 – 22). The combination of familiar elements is likely to be obvious when it does no more than yield predictable results. Furthermore, the simple substitution of one known element for another is likely to be obvious when predictable results are achieved. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007) (see MPEP § 2143). Consequently, as shown by Yamada, the use of

a film bulk acoustic piezoelectric resonators with a similar sensor would have been predictable to a person of ordinary skill in the art. The resonator devices in each of the prior art disclosures are similar in that they function via a piezoelectric resonance effect to perform measurements. Yamada additionally teaches the operational aspects of the disclosed resonators, e.g., when mechanically resonating, the acoustic resonator serves a role as an electrical resonator by the electrical energy/mechanical energy converting property of the piezoelectric material used in the resonator (see, e.g., col. 16, line 56 – col. 17, line 14). Yamada teaches a resonator device incorporating a support substrate comprising a typical silicon wafer 51 for supporting the resonators (see, e.g., Abstract; col. 11, lines 1 – 66; figures 1 – 6). as disclosed by Yamada in figure 11, the structure 60 comprising resonator 62 is attached to the substrate 51 at its edges and wherein the top electrode 63 has an exposed surface. Yamada further discloses the added benefits, such as reduced electronic equipment cost and size, of the disclosed film bulk acoustic piezoelectric resonators (see, e.g., col. 1, lines 24 – 48). A person of ordinary skill in the art would have recognized the suitability of using the resonator disclosed by Yamada in the configuration disclosed by Ward to facilitate detection. Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the substitution of a bulk film acoustic piezoelectric resonator, as disclosed by Yamada, in place of the resonator configuration of the detection device taught by Ward in order to facilitate effective sensing operation in a cost effective manner. Furthermore, it would have been obvious to a person of ordinary skill in the art to adapt or adjust the signal generating and measurement circuit of the disclosed detection device to facilitate detection using the incorporated film bulk acoustic resonator device.

Regarding claim 4, Yamada teaches the use of AlN and ZnO as resonator materials that are well known in the art (see col. 5, lines 51 – 58). The selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art (see MPEP § 2144.07).

Regarding claims 5 – 9, the control and signal generating circuits disclosed by the cited prior art are considered capable of being operated using these types of excitation signals.

2. Claims 14 – 21 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over the aforementioned cited prior art view of Blackburn et al. (U.S. Pat. No. 6,846,654 B1) ("Blackburn").

Regarding claims 14 – 21 and 24, the above cited prior art does not specifically teach the incorporation of an organic membrane as claimed.

Ward does teach the incorporation of a polymer film layer 22 for immobilization (see, e.g., col. 3, lines 45 – 58; figure 1). Ward further teaches spin-coating application of layer 22 and silanization of metal and glass surfaces of the device for facilitating immobilization of binding biomolecules (see col. 3, lines 46 – 58).

Blackburn teaches the use of an organic membrane as a support material for immobilizing binding biomolecules, i.e., antibodies. Blackburn also teaches the use of lipid bilayer membranes (see, e.g., col. 16, line 37 – col. 17, line 21; col. 18, lines 5 – 29). The selection of a known material, which is based upon its suitability for the intended use, is within the ambit of one of ordinary skill in the art (see MPEP § 2144.07). In addition, the use of silylation, acylation, esterification and alkylation are chemical derivatization methods for facilitating ligand immobilization that are well known in the art (see MPEP § 2144.03).

Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of an organic membrane as claimed with the disclosed sensing device.

3. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over the aforementioned cited prior art view of Gao et al. (U.S. Pat. No. 6,218,507 B1) ("Gao").

Regarding claim 31, the aforementioned cited prior art does not specifically teach the incorporation of a second piezoelectric resonator having a non-functionalized surface.

Ward does teach the incorporation of a secondary or reference piezoelectric resonator crystal (see col. 6, lines 5 – 20).

The use of a reference sensor comprising an uncoated portion, such as an electrode, with detection devices is well known in the art (see MPEP § 2144.03). For example, Gao teaches a related piezoelectric crystal resonator-based detection device comprising an uncoated or non-functionalized piezoelectric crystal electrode that functions to provide reference or control measurements. The determined measurement frequency is recorded as a base frequency and as a blank control measurement that is used with the coated sensing electrode to provide accurate gas detection measurements (see, e.g., col. 9, lines 3 – 16). Furthermore, the combination of familiar elements is likely to be obvious when it does no more than yield predictable results. See *KSR Int'l v. Teleflex Inc.*, 127 Sup. Ct. 1727, 1742, 82 USPQ2d 1385, 1397 (2007). Consequently, as indicated by Gao, a person of ordinary skill in the art would accordingly have recognized the suitability of incorporating such a secondary or reference electrode that is non-functionalized to provide accurate detection measurements. As shown by Gao, a person of ordinary skill in the art would accordingly have had a reasonable expectation for success of incorporating of a second piezoelectric resonator having a non-functionalized electrode surface as claimed with the

disclosed sensing device in order to facilitate accurate detection measurements. The prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success (see MPEP § 2143.02). Therefore, it would have been obvious to a person of ordinary skill in the art to incorporate the use of a second piezoelectric resonator having a non-functionalized electrode surface as claimed with the disclosed sensing device in order to facilitate accurate detection measurements.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian J. Sines whose telephone number is (571) 272-1263. The examiner can normally be reached on Monday - Friday (11 AM - 8 PM EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Brian J. Sines

Primary Examiner
Art Unit 1797

/Brian J. Sines/
Primary Examiner, Art Unit 1797